

NOTE

First Record of Female Adult *Atrichopogon* Kieffer
(Diptera: Ceratopogonidae) Biting in the Neotropical Region

Adult females of biting flies generally require two sources of nutrients. Sugars, mostly acquired from flowers or honeydew, are used to fuel flight and other activity and are also imbibed by males. In addition to this, most females of biting fly families need a source of protein, taken either from a vertebrate or invertebrate (and sometimes insect carrion), to develop their eggs (Downes 1958, 1971).

One peculiar feature of our understanding of the biting midges is the lack of feeding observations of adult females of species of *Atrichopogon* Kieffer. The genus has a worldwide distribution, includes 473 species (and undoubtedly many more undescribed), and many species are common in a wide array of areas with moist to wet habitats. They are one of the most abundant groups of Ceratopogonidae in Malaise trap samples and are often present in numbers on various small flowers. In spite of this, there are very few records of female *Atrichopogon* taking a bloodmeal (Table 1), even though most have serrate mandibles indicating that they are likely to do so. A few species, all restricted to the subgenus *Meloehalea* Wirth, feed on the blood of adult Meloidae or Oedermeridae and females of at least some of these are known to be attracted to the cantharadin emanating from these beetles. One species in the subgenus *Atrichopogon* has been observed on the wing of a moth, and there have been limited observations of females feeding on insect carrion (sometimes finding it in spider webs), one species feeding on a dead earthworm, and one unnamed species feeding on a mealy bug. A few species of

Atrichopogon, unique within the biting Nematocera, derive their female specific food by piercing pollen grains and sucking the pollen sap (Downes 1955, personal observation—*Carex* pollen). Downes and Smith (1969) suggested that the latter behaviour may be more widespread in the genus but provided no further observations. Fey (1954) and Neindorff (1959) reported *A. brunripes* (Meigen) and *A. (M.) oedemerarum* Storå, respectively, feeding on *Anthomyia pluvialis* (Linnaeus), a fly with cantharadin in its blood, under laboratory conditions but it is unknown whether such behavior occurs in nature.

In spite of their exceptional abundance and diversity, only eight named species of *Atrichopogon* (i.e., less than 2% of species worldwide) have been recorded feeding on other insects (or a dead earthworm) (Table 1) and all but one of these are from the Holarctic Region; the only other record is from southern India (the specimen sucking blood from a mealy bug).

Here we report the first observation of females of a species of *Atrichopogon* feeding in the Neotropical Region. Females of an *Atrichopogon* (*Atrichopogon*) sp. were observed sucking blood from the protruding deformed wings of two *Tetraonyx* (*Paratetraonyx*) *distincticollis* (Pic) (Meloidae) (Fig. 1). Three midges were seen on Dec. 17 and two on Dec. 28, 2005. Both *T. distincticollis* emerged with defective wings and walked slowly on vegetation near a nest of *Monoeca haemorrhoidalis* (Smith) (Apidae), which are parasitized by this meloid beetle. The specimens were collected from Parque Estadual Mananciais da Serra

Table 1. Hosts of female adult *Atrichopogon*.

Species	Reference	Host
<i>A. (A.) peregrinus</i> (Johannsen)	Malloch 1915	Dead earthworm
<i>A. (A.) infuscus</i> Goetghebuer	Vogel 1931	<i>Stauropus fagi</i> (Notodontidae: Lepidoptera)
<i>A. (M.) downesi</i> Wirth	Wirth 1980	<i>Epicauta</i> sp. (Meloidae: Coleoptera)
<i>A. (M.) epicautae</i> Wirth	Wirth 1956	<i>Epicauta cinctipennis</i> (Meloidae: Coleoptera)
	Wirth 1980	<i>Epicauta</i> sp. (Meloidae: Coleoptera)
<i>A. (M.) farri</i> Wirth	Farr 1954	<i>Epicauta fabricii</i> (Meloidae: Coleoptera)
(as <i>Atrichopogon</i> , n. sp.)	Wirth 1956	<i>Epicauta torsa</i> (Meloidae: Coleoptera)
	Wirth 1980	<i>Epicauta murina</i> (Meloidae: Coleoptera)
<i>A. (M.) lucorum</i> (Meigen)	Havelka 1979	<i>Meloe violaceus</i> (Meloidae: Coleoptera)
	Wirth 1980	<i>Meloe violaceus</i> (Meloidae: Coleoptera)
	Reder 1999	<i>Meloe proscarabaeus</i> (Meloidae: Coleoptera)
		<i>Lytta vesicatoria</i> (Meloidae: Coleoptera)
<i>A. (M.) winnertzi</i> Goetghebuer	Peyerimhoff 1917	<i>Meloe</i> (Meloidae: Coleoptera)
(as <i>Ceratopogon</i> sp.)	Kieffer 1922	<i>Meloe majalis</i> (Meloidae: Coleoptera)
(as <i>meloesusugans</i>)	Blair 1937, 1938	<i>Meloe proscarabaeus</i> (Meloidae: Coleoptera)
(as <i>meloesusugans</i>)		<i>Meloe violaceus</i> (Meloidae: Coleoptera)
	Mann and Turner 2003	<i>Meloe violaceus</i> (Meloidae: Coleoptera)
(as <i>meloesusugans</i>)	Krogerus 1936	<i>Meloe violaceus</i> (Meloidae: Coleoptera)
(as <i>meloesusugans</i>)	Storå 1937	<i>Meloe violaceus</i> (Meloidae: Coleoptera)
(as <i>meloesusugans</i>)	Cootes and Irwin 1982	<i>Meloe violaceus</i> (Meloidae: Coleoptera)
<i>A. (M.) oedemerarum</i>		
(as <i>rostratus</i>)	Hansen 1921	<i>Meloe proscarabeus</i> (Meloidae: Coleoptera)
(as <i>rostratus</i>)	Edwards 1923	<i>Meloe proscarabeus</i> (Meloidae: Coleoptera)
(as <i>rostratus</i>)	Korschefsky 1937	<i>Meloe violaceus</i> (Meloidae: Coleoptera)
	Storå 1939	<i>Oedemera flavescens</i> (Oedemeridae, Coleoptera)
		<i>Chrysanthia viridis</i> (Oedemeridae, Coleoptera)
		<i>Chrysanthia viridissima</i> (Oedemeridae, Coleoptera)
(as <i>rostratus</i>)	Heqvist 1948	<i>Meloe violaceus</i> (Meloidae: Coleoptera)
	Wirth 1956	<i>Epicauta fabricii</i> (Meloidae: Coleoptera)
	Wirth 1980	<i>Epicauta</i> sp. (Meloidae: Coleoptera)
<i>A. sp.</i>	Spencer 1958	<i>Epicauta oregana</i> (Meloidae: Coleoptera)
<i>A. sp.</i>	Edwards et al. 1939	Mealy bugs
<i>A. sp. D</i>	ownes and Smith 1969	Dead insects; dead insects in spider webs

(25°29'30"S and 48°59'30"W), Piraquara, Brazil, at an altitude of 917 m.

Two of the female *Atrichopogon* were studied taxonomically and appear conspecific. They are both members of the subgenus *Atrichopogon* (bare eyes, proboscis straight in profile, abundant macrotrichiae on the wing, lacking armature on abdominal sternite 7, one spermatheca) and were uniformly brown (i.e., no distinctive pigmentation patterns). Further identification is presently impossible because most *Atrichopogon* in

the Neotropical Region cannot be accurately identified (Borkent and Picado 2004).

All species of *Atrichopogon* previously recorded from Meloidae or Oedemeridae belong to the subgenus *Meloehelea* (Table 1), females of which have a uniquely modified anteriorly bent proboscis. Females of this subgenus obtain blood by piercing the intersegmental membrane of legs or the abdomen or, in one instance, the base of the antenna of the beetles. Cantharadin traps attract not only spe-



Fig. 1. Two female *Atrichopogon* (*Atrichopogon*) sp. (Ceratopogonidae) feeding on the deformed wing of *Tetraonyx distincticollis* (Meloidae).

cies of *A. (Melochelea)*, as would be expected, but also some species of *A. (Atrichopogon)* in the Holarctic and in areas as distant as Australia (pers. obs.). These latter species, however, have not been observed actually attacking meloid or oedermerid beetles (Wirth 1980). It is possible that our observation of an *A. (Atrichopogon)* sp. feeding on a Brazilian meloid is an aberrancy, considering that they were feeding on the deformed wings. Alternatively, females of *A. (Atrichopogon)* which are attracted to cantharadin may normally feed on deformed hosts or perhaps derive some other advantage by congregating near cantharadin-bearing beetles.

There remains a great need to make fresh observations of the feeding behavior of female adults of species of *Atrichopogon* to allow a better interpretation of their remarkable behavior.

The *Atrichopogon* specimens we studied are deposited in the Canadian National Collection (Ottawa, Canada).

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LITERATURE CITED

- Blair, K. G. 1937. Midges attacking *Meloe* beetles. *Entomologist's Monthly Magazine* 73: 143.
- . 1938. Midges attacking other insects. *Proceedings and Transactions of the South London Entomological and Natural History Society* 1937: 84-85.
- Borkent, A. and A. Picado. 2004. Distinctive new species of *Atrichopogon* Kieffer (Diptera: Ceratopogonidae) from Costa Rica. *Zootaxa* 637: 1-68.
- Cootes, J. and A. G. Irwin. 1982. Two insect associations from Scotland. *Entomologist's Monthly Magazine* 114: 156.

- Downes, J. A. 1955. The food habits and description of *Atrichopogon pollinivorus* sp. n. (Diptera: Ceratopogonidae). Transaction of the Royal Entomological Society of London 106: 439–453.
- . 1958. The feeding habits of biting flies and their significance in classification. Annual Review of Entomology 3: 249–266.
- . 1971. The ecology of blood-sucking Diptera: An evolutionary perspective, pp. 232–258. In Fallis, A. M., ed. Ecology and Physiology of Parasites: A Symposium. Toronto University Press, Toronto.
- Downes, J. A. and S. M. Smith. 1969. New or little known feeding habits in Empididae (Diptera). Canadian Entomologist 101: 404–408.
- Edwards, F. W. 1923. New and old observations on Ceratopogonine midges attacking other insects. Annals of Tropical Medicine and Parasitology 17: 19–29.
- Edwards, F. W., H. Oldroyd, and J. Smart. 1939. British blood-sucking flies. British Museum, London. viii + 156 pp., 45 pls.
- Farr, T. H. 1954. Heleidae (Diptera) attacking blister beetles in Massachusetts and Arizona. Bulletin of the Brooklyn Entomological Society 49: 88.
- Fey, F. 1954. Beiträge zur Biologie der canthariphilen Insekten. Vorläufige Mitteilung. Beiträge zur Entomologie 4: 180–187.
- Hansen, J. 1921. En Myg, der Angriber en Oliebille. Flora og Fauna: 106.
- Havelka, P. 1979. *Atrichopogon lucorum* (Meigen, 1818) (Diptera, Ceratopogonidae)—ein neuer temporärer, canthariphiler Ektoparasit am Ölkäfer *Meloe violaceus* Mrsh., 1802 (Coleoptera, Meloidae). Zeitschrift der Arbeitsgemeinschaft Österreichischer Entomologen 30: 117–119. (1978).
- Heqvist, K. 1948. En för Sverige ny, på *Meloe violaceus* L. blodsugande mygga (Dipt.). Opuscula Entomologica 13: 47–48.
- Kieffer, J. J. 1922. Nouveaux Chironomides piqueurs habitant l'Algérie. Archives de l'Institut Pasteur de l'Afrique du Nord 2: 494–518.
- Korschetsky, R. 1937. Beobachtungen an *Meloe violaceus* L. und *Notoxus monoceros* L. Arbeiten über physiologische und angewandte Entomologie 4: 157–158.
- Krogerus, R. 1936. Egendomligt levnadssätt hos nagra dipterer. Notulae Entomologicae, 27.
- Malloch, J. R. 1915. Some additional records of Chironomidae for Illinois and notes on other Illinois Diptera. Bulletin of the Illinois State Laboratory of Natural History 11: 305–363, pls. 80–84.
- Mann, D. J. and C. R. Turner. 2003. *Atrichopogon (Melochelea) wimmertzi* Goetghebuer (Diptera: Ceratopogonidae) feeding on *Meloe violaceus* Marsham (Coleoptera: Meloidae). British Journal of Entomology and Natural History 16: 7–9, errata: 16: 4.
- Neindorff, U. von. 1959. Beitrag zur Kenntnis der Heleiden-Fauna (Dipt., Nemat.). Mitteilungen Deutsche entomologische Gesellschaft 18: 31–35.
- Peyerimhoff, P. 1917. *Ceratopogon* (Dipt. Chironomidae) et *Meloe* (Col. Meloidae). Bulletin de la Société Entomologique de France 1917: 250–253.
- Reder, G. A. 1999. Beobachtungen bei einem Massenaufreten der Spanischen Fliege—*Lytta vesicatoria* (Linnaeus, 1758)—im südlichen Rheinhessen (Coleoptera: Meloidae). Fauna und Flora in Rheinland-Pfalz 9: 139–150.
- Spencer, G. J. 1958. The natural control complex affecting grasshoppers in the dry belt of British Columbia. Proceedings of the 10th International Congress of Entomology 4: 497–502.
- Storå, R. 1937. Mitteilungen über die Nematoceren Finnlands. Acta Soc. Fauna Flora Fennica 60: 256–266.
- . 1939. Mitteilungen über die Nematoceren Finnlands II. Notulae Entomologicae 29: 16–30.
- Vogel, R. 1931. Beobachtungen über blutsaugende Zweiflügler im Kanton Tessin. Zoologischer Anzeiger 93: 1–3.
- Wirth, W. W. 1956. The biting midges ectoparasitic on blister beetles (Diptera, Heleidae). Proceedings of the Entomological Society of Washington 58: 15–23.
- . 1980. A new species and corrections in the *Atrichopogon* midges of the Subgenus *Melochelea* attacking blister beetles (Diptera: Ceratopogonidae). Proceedings of the Entomological Society of Washington 82: 124–139.

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